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ABSTRACT

Several intermediate performance objectives and corresponding criterion measures are listed for a metals course for seventh, eighth, and ninth grade students. The seventh grade section includes 13 terminal objectives for a 9-week course and provides exploratory units in bench metals and sheet metals. Industrial materials and processes receive major emphasis. Basic activities covered are design, measuring, layout, cutting, forming, and fastening. The eighth grade section, a review of the seventh grade units with additional and advanced applications, includes 13 terminal objectives for a 9-week course. The ninth grade section is divided into two separate one-semester courses: (1) Machine Shop 1A is provided to review, reinforce, and expand the basic knowledge previously learned and contains 15 terminal objectives and (2) Machine Shop 1B contains 15 terminal objectives listed under the same headings: Safety, Introduction to Metals, Occupations, Lay-out and Measuring, Planning, Hand Tools, Abrasives, Drilling, Sheet Metals, Bench Metals, Welding, Forging, Lathe, and Finishing. (This manual and 54 others were developed for various secondary level vocational courses using the System Approach for Education (SAFE) guidelines.) (HD)

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JUNIOR HIGH SCHOOL

INDUSTRIAL ARTS

PERFORMANCE OBJECTIVES

ED139973

METALS

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CE 010 994

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Duval County Public Schools
July, 1972

MAKE UP AND USE OF THIS MANUAL

Definitions

Terminal Performance Objectives - are objectives referring to a behavior, knowledge, or skill you want the learner to demonstrate at the end of a particular unit or section. They are written in gross, overall terms.

Intermediate Performance Objectives - are sub-functions of terminal objectives referring to a behavior, knowledge, or skill you want the learner to demonstrate along the way towards mastery of the terminal objectives. They are written in specific terms.

Criterion Measures - are the actual tests of evaluation exactly as it will be presented to the learner to see if he has met the objectives.

Method Media Analysis - specifically refers to personnel resources, tools, vehicles, software, and hardware media - the physical hows for implementing the methods or ways of curriculum implementation. (Each media center is different in the materials available to assist the instructor in lecturing and demonstrating. Therefore, the individual instructor must research the school's media center for the appropriate materials to be used).

Levels of Performance - The levels of performance (how well it must be done) given in this manual have been arrived at by the authors through past experiences and by consultation with other Industrial Arts teachers in Duval County. These levels are subject to change after try out. They are written as average levels of attainment that all students should achieve. This by no means limits the instructor, who can teach as far above the level as possible.

These objectives are minimal - The objectives in this manual represent the basic "need to know" knowledge and skills that should be attainable by any student that meets the prerequisites of the courses.

Courses Prerequisites - The prerequisites for these courses may need revision. For example, if your course calls for a certain skill in reading ability and you are getting students below this ability that cannot perform up to the course standards, then a prerequisite of "must be able to read at the – level" may be needed.

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GENERAL METALS - MACHINE SHOP

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MACHINE SHOP IB - 9th GRADE

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GENERAL METALS

ACCREDITATION NO. 5861

LENGTH OF COURSE: 9 WEEKS

GRADE LEVEL: 7th

PROGRAM PATH: CAREER EDUCATION, EXPLORATORY, PRE-COLLEGE

PREREQUISITE(S): 7th GRADE STUDENT

COURSE DESCRIPTION:

Exploratory units in bench metals and sheet metals. Industrial materials and processes receive major emphasis. Basic activities are design, measuring, layout, cutting, forming, and fastening.

GENERAL METALS
7th GRADE

1.0 Orientation

2.0 Safety

3.0 Hand Tools for Metalworking

4.0 Measurement and Layout

5.0 Sheet Metal Cutting, Notching, and Deburring

6.0 Drilling and Punching Sheet Metal

7.0 Forming Sheet Metal

8.0 Fastening Sheet Metals

9.0 Cutting and Filing in Bench Metals

10.0 Drilling and Punching Heavy Metals

11.0 Forming Bench Metals

12.0 Fastening Bench Metals

13.0 Finishing

NOTE: This course was designed for a nine (9) week period of study. It will be the individual instructor's decision as to how extensively he covers the materials, depending on his own particular "time allotted" situation. This course was designed to follow a path from fundamental processes to an "in depth" study in sequential order. The instructor should not reverse the order in which The Terminal Performance Objectives are written, but should teach as far into each as time will permit.

COURSE GENERAL METALS
7th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 1.0

ORIENTATION

The learner will, with 80% proficiency, list in writing, his responsibilities in General Metals. He will also define the principle material to be used and list the area in which each will be used in this course.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
1.1	The learner will list, in writing, his responsibilities in General Metals. 1. Respect the rights of others. 2. Assume your share of responsibility for care and inventory of laboratory property. 3. Remember that the laboratory is a place to work and learn, not a place to play. 4. Think BEFORE you act in any situation. 5. Do not assume anything. If there is ANY doubt, refer to the textbook or ask your instructor. 6. Safety is everybody's concern. 7. Maintaining a clean and orderly laboratory is a responsibility shared by every class member. 8. Be in your seat or at your duty station when the class begins. 9. If you need help, ask for it. 10. Leave the class area ONLY with the permission and knowledge of the instructor.	1.1	List the responsibilities of the individual learner in General Metals 7th grade.
1.2	The learner will list, in writing, the areas of investigation to be pursued in General Metals. He will also define each and list major materials involved. (1) Basic Sheet Metal - shape design and construction using the following materials:	1.2	Write a brief description of the areas of investigation for General Metals, listing and defining the major material used in each.

COURSE GENERAL METALS

7th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 10 cont'd.

ORIENTATION

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
1.2	a. Galvanized Steel Sheet - mild steel rolled into thin sheets, then coated with zinc for protection. b. Mild Steel Sheet - mild steel rolled into thin sheets. c. Aluminum Sheet - aluminum rolled into thin sheets. (2) Wrought Metal - shape design and construction using the following materials: a. Mild Steel Shapes (band iron, rod, square, angle, tubing) b. Aluminum Shapes (flat, round, square, angle, tubing.)	12	

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 1.0

I. P. No.	M/M No.	Method / Media Selection
1.1	1.1.1	Lecture
1.2	1.2.1	Lecture Textbook Film Strips or Film Loops and 16 mm film (if available)

COURSE GENERAL METALS
7th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 2.0

SAFETY

The learner will, in writing, and/or orally, list and abide by the ten (10) major safety rules for General Metals 7th grade, and will follow the rules of good housekeeping in the laboratory.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
2.1	The learner will list ten (10) major safety rules for the General Metals laboratory pertaining to the 7th grade program. (1) No "horseplay" in the laboratory. (2) No running in the laboratory. (3) Wear eye protection where required. (4) Report ALL accidents immediately. (5) Ask permission BEFORE using any materials, tools, or equipment. (6) Ask for physical help when you need it. (7) Respect the rights of others. (8) Use the correct tool or process. (9) Report dull or broken tools. (10) Keep the work and walk areas clean. (11) Wear proper clothing. (12) Report any unsafe practice immediately (13) Know location and use of all fire extinguishers. (14) Know fire drill procedures. (15) Remove all jewelry and secure loose hair.	2.1	List ten (10) major safety rules for 7th grade General Metals.
2.2	The learner will follow the rules of good housekeeping in the laboratory. (1) Clean all assigned areas (2) Store all tools properly (3) Clean all equipment after use	2.2	You will be evaluated on your efforts and acceptance of responsibility for keeping the laboratory clean and orderly.

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 2.0

I. P. No.	M/M No.	Method / Media Selection
2.1	2.1.1	Lecture
		Textbook
		16mm film (if available)
2.2	2.2.1	Lecture
		Discussion
		Demonstration

COURSE GENERAL METALS
7th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 3.0

HAND TOOLS FOR METALWORKING

The learner, with 80% proficiency, will identify in writing or orally, twenty-five (25) hand metalworking tools, and he will explain the uses of at least five (5) of these tools.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
3.1	The learner will identify orally or in writing, the correct names for twenty-five (25) hand tools. (See attached sheet).	3.1	Identify orally or in writing, twenty-five (25) hand metalworking tools indicated by your instructor.
3.2	The learner will explain the uses of five (5) hand metalworking tools as selected by the instructor.	3.2	List, in writing, the uses of five (5) hand tools selected by your instructor.

1. Tin Snips

2. Curved or C-Snips

3. Aviation Snips

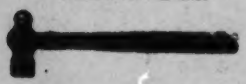
4. Hand Seamers

5. Hand Groover

6. Rivet Set

7. Scratch Awl

8. Ball Peen Hammer



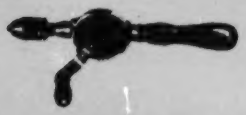
9. Engineer's Hammer

10. Tinners Hammer

11. Sledge Hammer

12. Mallet

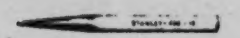
13. Hand Drill



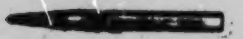
14. Twist Drill

15. Common Screwdriver

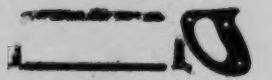
16. Prick Punch



17. Center Punch



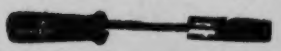
18. Hack Saw



19. Cold Chisel

20. C- Clamp

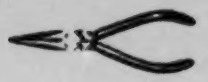
21. Soldering Copper



22. Lineman's Pliers

23. Combination Pliers

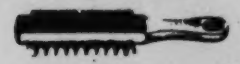
24. Needle-Nose Pliers



25. Safety Goggles

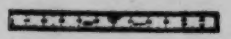
26 Safety Shield

27. File Card



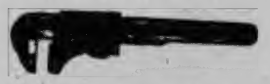
28.Sliding T-Bevel

29. Bench Rule



30. Circumference Rule

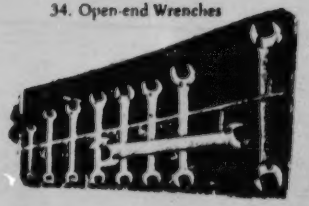
31. Monkey Wrench



32. Pipe Wrench

33. Adjustable Open-End Wrench

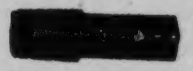
34. Open-end Wrenches



35. Try Square

36. Combination Square

37. Tap



38. Dies

39. Dividers

40. Blacksmith's Tongs

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METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 3.0

I. P. No.	M/M No.	Method / Media Selection
3.1	3.1.1	Demonstration
		Tool Catalogs
		Handout Sheets
		Textbook
		16mm film (if available)
		Tools
3.2	3.2.1	Lecture
		Research(textbook or media center)
		Film Strips
		Demonstration

COURSE GENERAL METALS
7th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 4.0

MEASUREMENT AND LAYOUT

The learner will, with 80% proficiency, demonstrate his accuracy in using the English system of linear measurement by accurately measuring objects, finding centers, and drawing a layout for both an angular development sheet metal experiment and a bench metal experiment involving two or more separate parts.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
4.1	The learner will measure and locate centers of ten (10) objects supplied by the instructor.	4.1	Indicate, in writing, the outside and center dimensions of ten (10) objects as selected by your instructor.
4.2	The learner will complete, on paper, a layout drawing using angular development of a sheet metal shape.	4.2	Make a stretch-out of a straight-side sheet metal shape from information supplied by your instructor.
4.3	The learner will make a full-size drawing showing all views necessary for shaping materials of a bench metal experiment. This should involve two or more separate pieces.	4.3	Draw a full-size layout for a bench metal experiment showing true shape of all parts necessary for construction.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 4.0

I. P. No.	M/M No.	Method / Media Selection
4.1	4.1.1	Demonstration
		Lecture
		Measuring Tools
4.2	4.2.1	Demonstration
		Lecture
		Paper
		Measuring Tools
		Textbook
		Models
4.3	4.3.1	Demonstration
		Lecture
		Paper
		Measuring Tools
		Pupell Compass
		Textbook

COURSE GENERAL METALS
7th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 5.0

SHEET METAL CUTTING, NOTCHING, AND DEBURRING

The learner will, using the prick punch method, transfer his paper pattern to the sheet metal. He will cut, and deburr the flat shape in the correct order. He will accomplish this with 80% proficiency.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
5.1	Using the prick punch method of transfer, the learner will lay out on sheet metal the sheet metal shape previously drawn on paper.	5.1	Use a prick punch, hammer, scratch awl, and straight-edge to transfer your drawing to the sheet metal.
5.2	The learner will use the appropriate sheet metal snips to cut his sheet metal to shape, notching where necessary.	5.2	Cut and notch sheet metal to shape.
5.3	Using a file or an abrasive, the learner will remove all burrs from the edges of the sheet metal prior to forming.	5.3	Remove all burrs from the edges of sheet metal using a file or abrasive material.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 5.0

I. P. No.	M/M No.	Method / Media Selection
5.1	5.1.1	Demonstration
		Sheet Metal
		Tools
		Film Strips (if available)
		Completed Drawing
5.2	5.2.1	Demonstration
		Sheet Metal
		Tools
		Film Strips (if available)
5.3	5.3.1	Demonstration
		Sheet Metal
		Tools

COURSE GENERAL METALS
7th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 6.0

DRILLING AND PUNCHING SHEET METAL

With 80% proficiency, the learner will locate, drill, or punch all rivet and/or screw holes in his sheet metal.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
6.1	Using prick and center punches, the learner will mark the location of all holes to be drilled or punched in his sheet metal shape.	6.1	Locate all holes to be drilled or punched in your sheet metal.
6.2	Using a hand sheet metal punch, a solid punch with a hammer, or a hand drill with appropriate size twist drills, the learner will drill or punch all screw and/or rivet holes in his sheet metal shape.	6.2	Drill or punch all rivet or screw holes in your sheet metal shape.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 6.0

I. P. No.	M/M No.	Method / Media Selection
6.1	6.1.1	Demonstration
		Sheet Metal
		Tools
		Textbook
		Completed Drawing
6.2	6.2.1	Demonstration
		Sheet Metal
		Tools
		Textbook

COURSE GENERAL METALS
7th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 7.0

FORMING SHEET METAL

The learner will, with 80% proficiency, use the bar folder, box and pan brake, sheet metal stakes, mallets, hammers, and hand seamers to form an angular sheet metal shape.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
7.1	The learner will use the bar folder to hem exposed edges of the sheet metal shape.	7.1	Hem exposed edges of the sheet metal.
7.2	Using the box and pan brake, the learner will form the ends and sides of the angular sheet metal shape in that sequence.	7.2	Form the ends and sides of the sheet metal shape in that sequence.
7.3	The learner will, using a mallet or hammer and appropriate sheet metal stakes, true all bends in the formed sheet metal shape.	7.3	True all bends in your sheet metal shape.

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METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 7.0

I. P. No.	M/M No.	Method / Media Selection
7.1	7.1.1	Demonstration
		Bar Folder
		Film Strip (if available)
		Textbook
		Sheet Metal
7.2	7.2.1	Demonstration
		Box and Pan Brake
		Film Strip (if available)
		Textbook
		Sheet Metal
7.3	7.3.1	Demonstration
		Sheet Metal
		Sheet Metal Stakes
		Tools
		Textbook
		Film Strip (if available)

COURSE GENERAL METALS
7th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 8.0

FASTENING SHEET METALS

With 30% proficiency, the learner will use rivets, sheet metal screws and /or stove bolts to secure all parts of an angular sheet metal shape into a single unit.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
8.1	The learner will use tinner's rivets or "pop rivets" to fasten corners of the formed sheet metal shape.	8.1	Set rivets using the appropriate type of setting device as provided by your instructor.
8.2	The learner will use "pop rivets", or sheet metal screws to fasten handles and other appendages.	8.2	Using fasteners most suited for use from one side of the sheet metal shape, secure handles or other appendages to your work.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 8.0

I. P. No.	M/M No.	Method / Media Selection
8.1	8.1.1	Demonstration
		Textbook
		Film Strip (if available)
		Tools
		Rivets
		Sheet Metal
8.2	8.2.1	Demonstration
		Textbook
		Film Strip (if available)
		Rivets
		Sheet Metal Screws
		Sheet Metal

COURSE GENERAL METALS
7th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 9.0

CUTTING AND FILING IN BENCH METALS

The learner will prepare all parts for a previously drawn bench metal shape by cutting them to length , and filing to shape or to remove burrs. He will do this with a proficiency of 80%.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
9.1	The learner will cut all parts necessary to construct a previously determined project using a bench shear or a hand hacksaw.	9.1	Cut all parts necessary to construct your project.
9.2	The learner will use files to remove the burrs and shape the ends of the individual parts, as per previously completed drawing.	9.2	Remove the burrs and shape the ends of each piece of metal to match your drawing. Clean your files with a file card.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 9.0

I. P. No.	M/M No.	Method / Media Selection
9.1	9.1.1	Demonstration
		Textbook
		Bench Shear
		Measuring and Marking Tools
		Completed Drawing
		Bar Metal
9.2	9.2.1	Demonstration
		Textbook
		Completed Drawing
		Tools
		Bar Metal

COURSE GENERAL METALS
7th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 10.0

DRILLING AND PUNCHING HEAVY METALS

The learner will drill or punch all rivet, screw, and bolt holes in the individual metal lengths. He will also use a countersink for removing burrs or for countersinking. He will complete both series of operations with a proficiency of 80%.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
10.1	The learner will drill or punch all previously located rivet, screw, or bolt holes in the individual lengths of metal using a drill press, hand power drill or punch.	10.1	After a demonstration by the instructor, drill or punch all previously located rivet, screw, or bolt holes in your metal.
10.2	The learner will use the appropriate metal countersink to remove the burrs or to countersink the drilled or punched holes.	10.2	After demonstration by the instructor, use a countersink to deburr or to countersink all holes.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 10.0

I. P. No.	M/M No.	Method / Media Selection
10.1	10.1.1	Demonstration
		Bar Metal
		Drilling / Punching Tools and Equipment
		Completed Drawing
		Textbook
		Film Strip or Loop (if available)
10.2	10.2.1	Demonstration
		Bar Metal
		Hand Drill or Drilling Machine
		Countersink
		Textbook
		Film Strip (if available)

COURSE GENERAL METALS
7th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 11.0

FORMING BENCH METALS

The learner will with 80% proficiency, bend the lengths of metal to fit the previously completed layout drawing.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
11.1	After a demonstration by the instructor, the learner will use hammers and a vise to make all angular bends in the bench metal lengths.	11.1	Make all angular bends in your metal using the appropriate hammer and a vise.
11. 2	After a demonstration by the instructor, the learner will use hammers and an anvil, bending jigs, or a "Metl Former" to complete all curved bends in his lengths of metal.	11.2	Use a hammer and an anvil or the appropriate bending jig, or a "Metl Former" to make all curved bends in your metal.
11.3	After a demonstration by the instructor, the learner will use a monkey wrench and a vise to form all twists in bench metal lengths.	11.3	Twist your metal using a monkey wrench and a vise.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 11.0

I. P. No.	M/M No.	Method / Media Selection
11.1	11.1.1	Demonstration
		Bar Metal
		Completed Drawing
		Vise
		Tools
		Textbook
		Film Strip (if available)
11.2	11.2.1	Demonstration
		Bar Metal
		Completed Drawing
		Anvil
		Bending Jigs
		"Metl Former"
11.3	11.3.1	Demonstration
		Textbook
		Vise
		Bar Metal
		Completed Drawing
		Tools

COURSE GENERAL METALS
7th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 12.0

FASTENING BENCH METALS

The learner will, with 80% proficiency, secure the various parts of his bench metal shape into a single unit using soft iron rivets or stove bolts.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
12.1	The learner will use a ball peen hammer and anvil or back-up plate to set rivets in previously drilled or punched rivet holes through two or more pieces of metal.	12.1	After a demonstration by the instructor, set the rivets in previously drilled holes using a ball peen hammer and available back-up device.
12.2	The learner will use the appropriate screwdriver and wrenches to complete securing the various parts of the project into a single unit with stove bolts.	12.2	After a demonstration by the instructor, complete assembly of your project using stove bolts, screwdrivers and wrenches.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 12.0

I. P. No.	M/M No.	Method / Media Selection
12.1	12.1.1	Demonstration
		Formed Bench Metal Project
		Textbook
		Film Strip (if available)
		Anvil
		Back-up plate
		Ball Peen Hammer
		Rivets
12.2	12.2.1	Demonstration
		Formed Bench Metal Project
		Textbook
		Tools
		Stove Bolts
		Film Strip (if available)

COURSE GENERAL METALS
7th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 13.0 FINISHING

The learner will, with 80% proficiency, apply appropriate finishing techniques or materials to protect or decorate his completed project.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
13.1	The learner will use abrasive cloth, steel wool, and/or lacquer thinner to remove oxidation and grease from the completed project.	13.1	Clean oxidation and grease from your project with materials provided by your instructor.
13.2	The learner will apply protective or decorative coating to the completed project following one of these schedules: (a) Apply paste wax in a series of thin coats buffing with a soft cloth between coats. (b) Etch galvanized prior to painting with acetic acid or vinegar. (c) Apply lacquer or enamel by spraying or brush to the completed projects using the appropriate undercoat for the base material and the particular finish. (d) Use oil and open flame to smoke (bench metal only) the surface of the metal, if desired finish with paste wax.	13.2	(a) Etch galvanized in preparation for painting with solution provided by your instructor. (b) Apply finish to your completed project as directed by your instructor.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 13.0

I. P. No.	M/M No.	Method / Media Selection
13.1	13.1.1	Lecture
		Abrasive Cloth
		Steel Wool
		Lacquer Thinner
		Rags
		Completed Project
13.2	13.2.1	Lecture
		Demonstration
		Completed Project
		Brushes
		Acetic Acid
		Rags
		Wax
		Oil
		Lacquer
		Paint or Enamel
		Soldering Furnace or Gas Torch
		Textbook
		Film Strip (if available)

GENERAL METALS

ACCREDITATION NO. 5862

LENGTH OF COURSE: 9 WEEKS

GRADE LEVEL: 8th GRADE

PROGRAM PATH: CAREER EDUCATION, EXPLORATORY, PRE-COLLEGE

PREREQUISITE(S): 8th GRADE STUDENT

COURSE DESCRIPTION:

Exploratory units in bench metals and sheet metals. Review of the 7th grade units with additional and advanced applications.

GENERAL METALS
8th GRADE

1.0 Orientation

2.0 Safety

3.0 Hand Tools For Metalworking

4.0 Measurement and Layout

5.0 Sheet Metal Cutting, Notching, and Deburring

6.0 Drilling and Punching Sheet Metals

7.0 Forming Sheet Metal

8.0 Fastening Sheet Metals

9.0 Cutting and Filing Bench Metals

10.0 Drilling and Punching Heavy Metals

11.0 Forming Bench Metals

12.0 Fastening Bench Metals

13.0 Finishing

NOTE: This course was designed for a nine (9) week period of study. It will be the individual instructor's decision as to how extensively he covers the materials, depending on his own particular "time allotted" situation. This course was designed to follow a path from fundamental process to an "in depth" study in sequential order. The instructor should not reverse the order in which The Terminal Performance Objectives are written, but should teach as far into each as time will permit.

COURSE GENERAL METALS
8th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 1.0

ORIENTATION

The learner will, with 80% accuracy, list in writing his responsibilities in General Metals. He will define the principle materials to be used and list the particular area in which each will be used in this course.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
1.1	The learner will list, in writing, his responsibilities in General Metals 8th grade. 1. Respect the rights of others. 2. Assume your share of responsibility for care and inventory of shop property. 3. Remember that the laboratory is a place of work and learn, not a place to play. 4. Think BEFORE you act in any situation. 5. Do not assume anything. If there is ANY doubt, refer to the textbook or ask your instructor. 6. Safety is everybody's concern. 7. Maintaining a clean and orderly laboratory is a responsibility shared by every class member. 8. Be in your seat or at your duty station when the class begins. 9. If you need help ask for it. 10. Leave the class area ONLY with the permission and knowledge of the instructor.	1.1	List the responsibilities of the individual learner in General Metals 8th grade.
1.2	The learner will list, in writing, the areas to be explored in General Metals 8th grade and define the major material to be used in each. (1) Basic Sheet Metal - design, layout, and construction of a sheet metal project using the following materials:	1.2	Write a brief description of the areas of investigation for General Metals, listing and defining the major material used in each.

COURSE GENERAL METALS
8th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 1.0 cont'd.

ORIENTATION

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
	a. Mild Steel Sheet - mild steel rolled into thin sheets. b. Galvanized Mild Steel Sheet - mild steel rolled into thin sheets then coated with zinc for protection. c. Aluminum Sheet - aluminum rolled into thin sheets. (2) Bench Metal - shape design, laycut and construction using the following materials: a. Mild Steel Shapes - (Band iron, rod, square, angle, tubing) b. Aluminum Shapes - (flat, round, square, angle, tubing)		

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 1.0

I. P. No.	M/M No.	Method / Media Selection
1.1	1.1.1	Lecture
		Charts
		Demonstrations
1.2	1.2.1	Lecture
		Materials
		Demonstrations
		Text

COURSE GENERAL METALS
8th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 2.0 — SAFETY

The learner will, in writing and/or orally, list and practice the ten (10) major safety rules for General Metals. He will indicate by performance a complete comprehension of the rules of good housekeeping for a General Metals laboratory.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
2.1	The learner will list ten (10) major safety rules for the General Metals laboratory pertaining to the 8th grade program. (1) No "horseplay" in the laboratory. (2) Never run in the laboratory. (3) Wear eye protection where required. (4) Report ALL accidents immediately. (5) Ask permission BEFORE using any materials, tools or equipment. (6) Ask for help when you need it. (7) Respect the rights of others. (8) Know location and use of all fire extinguishers (9) Use the correct tool or process. (10) Know the correct fire drill procedures. (11) Report dull or broken tools. (12) Keep work and walk areas clean. (13) Wear proper clothing. (14) Report any unsafe practice. (15) Secure all loose clothing and hair.	2.1	List ten (10) major safety rules for General Metals 8th grade.
2.2	The learner will practice the rules of good housekeeping (1) Clean assigned areas well (2) Clean all tools after use (3) Store all tools properly (4) Clean equipment after use	2.2	You will be evaluated on your efforts and acceptance of responsibility for keeping the laboratory clean and orderly.

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 2.0

I. P. No.	M/M No.	Method / Media Selection
2.1	2.1.1	Lecture
		Charts
		Demonstration
		Materials
		Film
2.2	2.2.1	Lecture
		Demonstration
		Observation

COURSE GENERAL METALS
8th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 3.0

HAND TOOLS FOR METALWORKING

The learner will, with 80% accuracy, identify by names and in writing, twenty-five (25) hand metalworking tools, and he will explain orally the uses of at least five (5) of these tools.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
3.1	The learner will write the correct names for twenty-five (25) hand metalworking tools.	3.1	Identify, in writing, the twenty-five (25) hand metalworking tools indicated by your instructor.
3.2	The learner will indicate verbally, the uses of five (5) hand metalworking tools selected by the instructor.	3.2	Explain, verbally, the uses of the tools indicated by your instructor.

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 3.0

I. P. No.	M/M No.	Method / Media Selection
3.1	3.1.1	Lecture
		Tools
		Demonstration
3.2	3.2.1	Lecture
		Tools
		Demonstration

1. Tin Snips

2. Curved or C-Snips

3. Aviation Snips

4. Hand Seamers

5. Hand Groover

6. Rivet Set

7. Scratch Awl

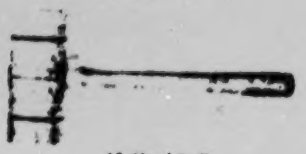
8. Ball Peen Hammer

9. Engineer's Hammer

10. Tinners Hammer

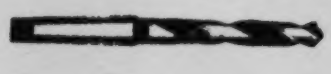
11. Sledge Hammer

12. Mallet



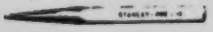
13. Hand Drill

14. Twist Drill

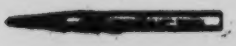


15. Common Screwdriver

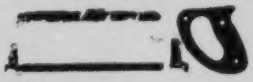
16. Prick Punch



17. Center Punch



18. Hack Saw



19. Cold Chisel

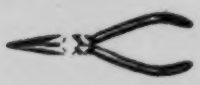
20. C- Clamp

21. Soldering Copper

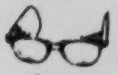
22. Lineman's Pliers

23. Combination Pliers

24. Needle-Nose Pliers



25. Safety Goggles

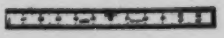


26 Safety Shield

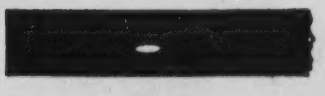
27. File Card

28.Sliding T-Bevel

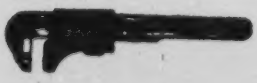
29. Bench Rule



30. Circumference Rule

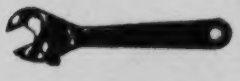


31. Monkey Wrench

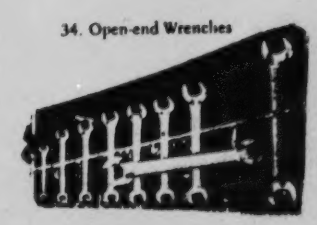


32. Pipe Wrench

33. Adjustable Open-End Wrench



34. Open-end Wrenches



35. Try Square

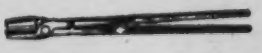
36. Combination Square

37. Tap

38. Dies

39. Dividers

40. Blacksmith's Tongs



COURSE GENERAL METALS
8th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 4.0

MEASUREMENT AND LAYOUT

The learner, with 80% proficiency, will demonstrate his ability to use the English system of linear measurement by accurately measuring objects, finding centers, drawing a layout for an angular development and a layout for a bench metal project which has two or more separate parts.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
4.1	The learner will measure correctly and locate centers of ten (10) objects supplied by the instructor.	4.1	Indicate, in writing, the outside and center dimensions of ten (10) objects as selected by your instructor.
4.2	The learner will complete, on paper, a layout drawing for a sheet metal shape, using angular or straight-line development.	4.2	Make a stretch-out (full size layout) of a straight-sided sheet metal shape from information supplied by your instructor.
4.3	The learner will make a full-size project drawing showing all views necessary for shaping materials of a bench metal shape. This project shape should involve two (2) or more separate pieces.	4.3	Draw a full-size layout for a bench metal shape showing true shape of all parts necessary for construction.

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 4.0

I. P. No.	M/M No.	Method / Media Selection
4.1	4.1.1	Lecture
		Chalkboard
		Demonstration
		Sample Objects
4.2	4.2.1	Lecture
		Demonstration
		Text
		Film Strip
		Materials
4.3	4.3.1	Lecture
		Demonstration
		Text
		Chalkboard
		Materials

COURSE GENERAL METALS
8th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 5.0

SHEET METAL CUTTING, NOTCHING, AND DEBURRING

The learner will, with 80% proficiency, using the prick punch method, transfer his paper pattern to sheet metal, cut, notch, and deburr the flat sheet metal shape in the correct order.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
5.1	Using the prick punch method of transfer, the learner will lay out on sheet metal the sheet metal shape previously drawn on paper.	5.1	Transfer your drawing to sheet metal.
5.2	The learner will use the appropriate sheet metal snips to cut his sheet metal to shape, notching where necessary.	5.2	Cut and notch your sheet metal to shape.
5.3	Using a file or an abrasive, the learner will remove all burrs from the edges of the sheet metal prior to forming.	5.3	Remove all burrs from the edges of the sheet metal.

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 5.0

I. P. No.	M/M No.	Method / Media Selection
5.1	5.1.1	Film Strips or Loops
		Text
		Demonstration
		Tools and Materials
5.2	5.2.1	Text
		Demonstration
		Tools and Materials
5.3	5.3.1	Text
		Demonstration
		Tools and Materials

COURSE GENERAL METALS

8th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 6.0

DRILLING AND PUNCHING SHEET METAL

With 80% proficiency, the learner will locate, drill, punch, or rivet all holes in his sheet metal.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
6.1	The learner will use prick and center punches to locate the centers of all holes to be drilled or punched in his sheet metal shape.	6.1	Locate the centers of all holes to be punched or drilled in your sheet metal.
6.2	The learner will use a hand sheet metal punch, a solid punch with a hammer or a hand drill with the correct size twist drill to drill or punch all rivet or screw holes in his sheet metal shape.	6.2	Drill or punch all rivet and screw holes in your sheet metal.

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 6.0

I. P. No.	M/M No.	Method / Media Selection
6.1	6.1.1	Film Strips or Loops
		Text
		Demonstration
		Tools and Materials
6.2	6.2.1	Text ..
		Demonstration
		Tools and Materials

COURSE GENERAL METALS
8th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 7.0

FORMING SHEET METAL

The learner will use the bar folder, box and pan brake, sheet metal stakes, mallets, hammers, and hand seamers to form an angular sheet metal shape.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
7.1	The learner will use the bar folder to hem exposed edges of the sheet metal shape.	7.1	Hem exposed edges of your sheet metal.
7.2	Using the box and pan brake, the learner will form ends and sides of the angular sheet metal shape in correct sequence.	7.2	Bend ends and sides of your sheet metal shape.
7.3	Using a mallet or hammer and the appropriate sheet metal stakes, true all bends in the formed sheet metal shape.	7.3	True all bends if necessary.

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 7.0

I. P. No.	M/M No.	Method / Media Selection
7.1	7.1.1	Film Strip or Loop
		Demonstration
		Text
		Tools, Equipment and Materials
7.2	7.2.1	Demonstration
		Tools, Equipment and Materials
7.3	7.3.1	Demonstration
		Tools, Equipment and Materials

COURSE GENERAL METALS
8th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 8.0

FASTENING SHEET METALS

The learner will, with 80% proficiency, secure all seams in his sheet metal shape. He will accomplish this with tinner's rivets, "pop rivets", sheet metal screws, stove bolts or by spot welding.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
8.1	The learner will use tinner's rivets, "pop rivets", or the spot welder to fasten corner seams in his sheet metal shape.	8.1	Fasten all corner seams.
8.2	The learner will use "pop rivets", sheet metal screws, or stove bolts to secure handles, other appendages, and any "hard to get to" seams.	8.2	Use fasteners most suited for use from one side of the sheet metal shape to secure handles and other appendages to your work.

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 8.0

I. P. No.	M/M No.	Method / Media Selection
8.1	8.1.1	Demonstrations
		Tools
		Equipment
		Materials
8.2	8.2.1	Demonstrations
		Tools
		Equipment
		Materials
		Text

COURSE GENERAL METALS
8th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 9.0

CUTTING AND FILING IN BENCH METALS

The learner will cut to length, all parts required for his previously drawn bench metal project. He will shape the ends of these parts by filing. These steps will be accomplished with a proficiency of 80%.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
9.1	The learner will measure and cut to length all parts required for construction of his previously drawn bench metal project. He will accomplish this with a bench shear or a hand hacksaw.	9.1	Cut to length all parts necessary to construct your bench metal project.
9.2	The learner will use files to remove burrs and shape the ends of each part cut for the bench metal project.	9.2	Remove any burrs left by the cutting operations and shape the end of each piece to match your drawing. Clean your files with a file card.

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 9.0

I. P. No.	M/M No.	Method / Media Selection
9.1	9.1.1	Film
		Demonstration
		Tools
		Equipment
		Materials
9.2	9.2.1	Demonstration
		Tools
		Equipment
		Materials

COURSE GENERAL METALS
8th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 10.0

DRILLING AND PUNCHING HEAVY METALS

The learner will use the drill press, or a power hand drill with twist drills and/or a bench-mounted hand metal punch to produce all rivet, screw and bolt holes in the individual lengths of metal. He will also use a countersink with either a hand or power drill for removing burrs from these holes or for countersinking. He will complete both series of operations with a proficiency of 80%.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
10.1	The learner will drill or punch all previously located rivet, screw or bolt holes in the individual lengths of metal.	10.1	Drill or punch all previously located rivet, screw or bolt holes in your metal.
10.2	The learner will use the appropriate metal countersink to remove the burrs or to countersink the drilled or punched holes	10.2	Use the appropriate countersink for countersinking or deburring where necessary.

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 10.0

I. P. No.	M/M No.	Method / Media Selection
10.1	10.1.1	Film
		Demonstration
		Text
		Tools
		Materials
		Equipment
10.2	10.2.1	Demonstration
		Tools
		Materials
		Equipment

COURSE GENERAL METALS
8th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 11.0 FORMING BENCH METALS

The learner will use hammers, anvil, machinist vise, various bending jigs, monkey wrench, or "Metl Former" to bend the metal lengths to fit the previously completed layout drawing. He will accomplish this with 80% proficiency.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
11.1	The learner will use hammers and a vise to make all angular bends in the metal lengths.	11.1	Make all angular bends in your metal.
11.2	The learner will use hammers and an anvil, bending jigs or "Metl Former" to complete all curved bends in his lengths of metal.	11.2	Make all curved bends in your metal.
11.3	The learner will use a monkey wrench and a vise to form all twists in bench metal lengths.	11.3	Twist your metal if required.

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 11.0

I. P. No.	M/M No.	Method / Media Selection
11.1	11.1.1	Film
		Demonstration
		Tools
		Equipment
		Materials
11.2	11.2.1	Demonstration
		Tools
		Equipment
		Materials
11.3	11.3.1	Demonstration
		Tools
		Equipment
		Materials

COURSE GENERAL METALS
8th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 12.0

FASTENING BENCH METALS

The learner will, with 80% proficiency, secure the various parts of his bench metal shape into a single unit. This will be accomplished through the use of soft iron rivets or with stove bolts.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
12.1	The learner will use a ball peen hammer and an anvil or back-up plate to set rivets in previously drilled or punched rivet holes through two or more pieces of metal.	12.1	Set rivets in previously drilled holes.
12.2	The learner will use appropriate screwdrivers and wrenches to complete securing various parts of the bench metal shape into a single unit stove bolt.	12.2	Complete assembly of your bench metal project.

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 12.0

I. P. No.	M/M No.	Method / Media Selection
12.1	12.1.1	Demonstration
		Text
		Tools
12.2	12.2.1	Material
		Equipment

COURSE GENERAL METALS
8th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 13.0 FINISHING

The learner will, with 80% proficiency, apply appropriate finishing techniques and materials to protect and decorate his completed project.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
13.1	The learner will use abrasive cloth, steel wool, and/or lacquer thinner to remove oxidation and contaminants from the completed project.	13.1	Use materials provided by your instructor to clean your project.
13.2	The learner will apply protective or decorative coating to the completed project following one of the following schedules: (a) Apply paste wax in a series of thin coats buffing with a soft cloth between coats. (b) Etch galvanized prior to application of paint. (c) Apply lacquer or enamel.	13.2	Apply finish to your completed project as directed by your instructor.

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 13,0

I. P. No.	M/M No.	Method / Media Selection
13.1	13.1.1	Demonstration
		Tools
		Materials
13.2	13.2.1	Demonstration
		Tools
		Materials

MACHINE SHOP IA

ACCREDITATION NO. 5847A

LENGTH OF COURSE: 1 SEMESTER

GRADE LEVEL: 9th

PROGRAM PATH: CAREER EDUCATION, PRE-TECHNICAL, COLLEGE

PREREQUISITE(S): 7th & 8th METALS

COURSE DESCRIPTION:

This course of study is designed as a 9th grade level course of (1) one semester's length. It is to be followed to review, reinforce and expand the basic knowledge previously learned.

MACHINE SHOP IA

1.0 Orientation

2.0 Safety

3.0 Introduction to Metals

4.0 Occupations

5.0 Lay-out and Measuring

6.0 Planning

7.0 Hand Tools

8.0 Drilling Operations

9.0 Fastening

10.0 Abrasives

11.0 Finishing

12.0 Sheet Metals

13.0 Bench Metals

14.0 Welding

15.0 Forging

16.0 Lathe

COURSE DESCRIPTION:

This course of study has been designed to incorporate both Machine Shop IA (Accreditation No. 5847A) and Machine Shop IB (Accreditation No. 5847B). Each are ninth (9th) grade level courses and designed for one (1) semester in length. Metals 7 (No. 5861) and Metals 8 (No. 5862) constitute the foundation for these courses of study and to introduce, review, or reinforce basic skills were repeated in part. Additions were made to increase the scope and content.

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 1.0 ORIENTATION

The learner will define in writing, with 80% proficiency, the rules and regulations governing conduct in the metals laboratory. He will also define the grading system used.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
1.1	The learner will write the basic rules and regulations governing conduct and responsibilities in the metals laboratory. 1. No horseplay 2. Take care of the tools and equipment 3. Use the right tool for the job 4. Be a good housekeeper 5. Observe all safety rules	1.1	Write the five (5) rules and regulations governing conduct and responsibilities for the metals laboratory.
1.2	The learner will, in writing, demonstrate his understanding of the grading system used and will determine his letter grade using the approved criteria measurements.	1.2	Using the instructor approved criteria measurements, compute, in writing, your grade for a grading period.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 1.0

I. P. No.	M/M No.	Method / Media Selection
1.1	11.1	Text
		Handout
		Lecture
1.2	1.2.1	Lecture
		Chalkboard
		Examination sheet

COURSE MACHINE IA
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 2.0 SAFETY

The learner will demonstrate, by performance and in writing, his ability to understand and abide by the rules of safety as they apply to the metals laboratory .

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
2.1	Given a written examination, the learner will list and define, in writing, the rules of safety for the metals laboratory. 1. The laboratory is a place for work, not horseplay. 2. Dress safely. 3. Wear eye protection where required. 4. Take proper care of tools. 5. Use tools properly. 6. Keep the tools sharp and in good condition. 7. Get permission before operating any machinery. 8. Never adjust or oil a moving machine. 9. Keep guards in place. 10. Be a good housekeeper. 11. Report all injuries to the instructor.	2.1	List, in writing, the safety rules given you by your instructor and write a brief description of each demonstrating your understanding of these rules.
2.2	The learner will demonstrate, by daily activities, his understanding of and willingness to obey the laboratory safety rules.	2.2	You will be observed daily on your willingness to abide by and practice the rules of safety.

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 2.0

I. P. No.	M/M No.	Method / Media Selection
2.1	2.1.1	Lecture
		Demonstration
		Handout Sheet
		Film
		Slides
2.2	2.2.1	Lecture
		Film

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 3.0 INTRODUCTION TO METALS

By performance and written examination, the learner will identify the properties and physical characteristics of various metals with 75% proficiency.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
3.1	The learner will define these metal terms in writing. A. Ferrous - contains iron B. Non-Ferrous - contains no iron C. Alloy - mixture of two (2) or more metals	3.1	Define, in writing, the terms: 1) Ferrous 2) Non-Ferrous 3) Alloy
3.2	Given seven (7) metal characteristics, the learner will define each in writing. 1) Hardness - resistance to penetration 2) Brittleness - susceptibility to fracture 3) Malleability - ability to be hammered ot rolled to shape. 4) Dúctility - ability to be drawn to shape 5) Elasticity - ability to return to original shape. 6) Fusibility - ease of liquification by heating 7) Machinability - machining ease	3.2	Given seven (7) characteristics of metals, define each in writing.
3.3	The learner will orally identify seven (7) given metal samples. Cast iron Mild steel Tool steel Aluminum Copper Brass Lead	3.3	Orally identify the seven (7) metal samples handed you by your instructor.

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 3.0

I. P. No.	M/M No.	Method / Media Selection
3.1	3.1.1	Lecture Samples Handout Sheet
3.2	3.2.1	Lecture Film Samples Handout Sheet
3.3	3.3.1	Lecture Demonstration Samples Film

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 4.0 OCCUPATIONS

The learner will, with 75% proficiency, in writing, list the occupational opportunities available in metalworking. He will also choose one of these areas and research the opportunities, the advantages, and the disadvantages of this particular area.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
4.1	The learner will list, in writing, eight (8) occupational opportunities in the fields of metalworking. The list may include the following: 1) Machinist 2) Tool & Die Makers 3) Sheet Metal Layout Men 4) Pattern Makers (Foundry) 5) Welders, Arc 6) Machine Tool Operators 7) Machinery Maintenance Men 8) Molders & Coremakers (Foundry) 9) Draftsmen 10) Electronics Technicians 11) Hydraulics Repairmen 12) Metalurgists 13) Computer Programmers 14) Engineers, Mechanical 15) Salesmen	4.1	List, in writing, eight (8) occupational opportunities in the fields of metalworking.
4.2	The learner will research and write a two-hundred (200) word composition on one of the occupational opportunities in metalworking.	4.2	Choose an occupational opportunity from a list of metalworkers and write a two-hundred (200) word composition pertaining to that area including the advantages and disadvantages.

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 4.0

I. P. No.	M/M No.	Method / Media Selection
4.1	4.1.1	Lecture
		Film
		Media Center Material
		Text
4.2	4.2.1	Lecture
		Film
		Media Center
		Text

COURSE MACHINE SHOP IA

9th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 5.0

LAYOUT AND MEASURING

The learner will identify orally seven (7) basic measuring and six (6) basic layout tools and will demonstrate by performance or in writing, the proper use of each.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
5.1	The learner will identify orally, these seven (7) basic measuring tools. 1. Steel rule 2. Steel square 3. Combination square 4. Sheet metal gage 5. Inside calipers 6. Outside calipers 7. Hermaphrodite calipers	5.1	From a display showing the seven (7) basic hand tools for measuring, orally identify each.
5.2	The learner will identify orally, these six (6) basic layout hand tools. 1. Hammer (ball peen) 2. Plastic mallet 3. Prick punch 4. Center punch 5. Dividers 6. Scribe	5.2	From a display showing the six (6) basic layout tools, orally identify each.
5.3	The learner will demonstrate, in writing, his ability to measure straight lines divided into fractions of 1/16 inch.	5.3	On the examination sheet, using a steel rule and a pencil, draw the follwing lines: 1. 3 1/2 2. 4 1/16 3. 3 3/4 4. 5 5/16 5. 2 1/4 6. 3 1/8 7. 4 9/16 8. 5 11/16
5.4	The learner will measure and record the diameters of two (2) cylindrical metal shapes using the following measuring tools:	5.4	Given two metal shapes (one solid cylinder and one hollow cylinder) write the outside diameter of both, and the inside diameter of the hollow cylinder.

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 5.0 cont'd. LAYOUT AND MEASURING

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
5.4	1. Steel rule 2. Outside calipers 3. Inside calipers		
5.5	The learner will measure sheet metal thickness using a thickness gage.	5.5	Using a sheet metal gage, write the measurements of the sheet metal samples.
5.6	The learner will demonstrate his ability to locate the center of a cylindrical metal piece, using a centering head from a combination set.	5.6	With a centering head and a scribe, locate the center of the cylindrical sample.

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 5.0

I. P. No.	M/M No.	Method / Media Selection
5.1	5.1.1	Lecture
		Demonstration
		Film
		Tools
5.2	5.2.1	Lecture
		Demonstration
		Film
		Tools
5.3	5.3.1	Lecture
		Demonstration
		Handout Sheet
		Film
		Bench Rule
5.4	5.4.1	Demonstration
		Film
		Tools and Equipment
		Handout Sheet
5.5	5.5.1	Demonstration
		Tools and Equipment
		Metal Samples
		Handout Sheet

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 5.0

I. P. No.	M/M No.	Method / Media Selection
5.6	5.6.1	Demonstration Tools and Equipment Metal Sample

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 6.0 PLANNING

The learner will, in writing, , with 80% proficiency, demonstrate his understanding of a planning and procedure sheet by successfully completing both.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
6.1	The learner will, in writing, complete the planning sheet for an assigned or selected metal project, to be completed in the laboratory. Include on this sheet the following: (See attached form). 1. Name 2. Grade and homeroom section 3. Name of project 4. Date started 5. Date completed (by the instructor) 6. Bill of materials: Thickness, width, and length of each piece Name of the part Material to be used for each part 7. A freehand or mechanically drawn sketch of the project. 8. Tools and materials to be used.	6.1	Complete, in writing, the planning sheet issued by your instructor.
6.2	The learner will, in writing, complete a procedure sheet, on the project selected in I. P. O. 6.1. (See attached form).	6.2	Complete a procedure sheet listing completion steps from layout to finish.

PLANNING SHEET

Date started----------
Date completed----------

Name---------- Grade ----------
Project---------- H/R Section ----------

BILL OF MATERIALS:

No. of pieces	size T	size W	size L	Name of part	Material	Unit cost	Total cost

EQUIPMENT AND TOOLS:

PROCEDURE OR STEPS:

1. Cut out stock.
2. Make part 1.
   a.
   b.
   c.
   d.
3. Make part 2.
   a.
   b.
   c.
   Etc
4. Make part 3.
5. Assemble.
6. Finish.

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METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 6.0

I. P. No.	M/M No.	Method / Media Selection
6.1	6.1.1	Lecture Demonstration Handout Planning Sheet
6.2	6.2.1	Lecture Handout Sheet

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 7.0 HAND TOOLS

With 70% proficiency, the learner will identify, orally, thirty (30) basic hand tools of the Machine Shop and will demonstrate his ability to clean and store these tools.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
7.1	The learner will, shown the following thirty (30) basic hand tools, orally identify each. 1. hack saw 2. cold chisel 3. twist drill 4. counter sink 5. file - single cut 6. file - double cut 7. file - rasp 8. file - curved tooth 9. tap 10. tap wrench 11. pliers, combination, slip joint 12. pliers, lineman's side-cutting 13. pliers, needle nose 14. pliers, diagonal cutting 15. open-end wrench 16. box-end wrench 17. combination wrench 18. adjustable open-end wrench 19. pipe wrench 20. monkey wrench 21. tin snips 22. aviation snips 23. hand seamers 24. tinner's riveting hammer 25. hand groover 26. rivet set 27. standard screwdriver 28. phillips screwdriver 29. C - clamp 30. reamer	7.1	From a display of the thirty (30) basic hand tools orally identify each.

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 7.0 cont'd. HAND TOOLS

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
7.2	The learner will demonstrate his ability to clean and properly store the basic hand tools.	7.2	After instruction on cleaning and storage of the hand tools, you will be observed daily on your ability and willingness to follow these instructions.

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 7.0

I. P. No.	M/M No.	Method / Media Selection
7.1	7.1.1	Lecture
		Demonstration
		Film
		Tools
7.2	7.2.1	Demonstration
		Film
		Observation

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 8.0 DRILLING OPERATIONS

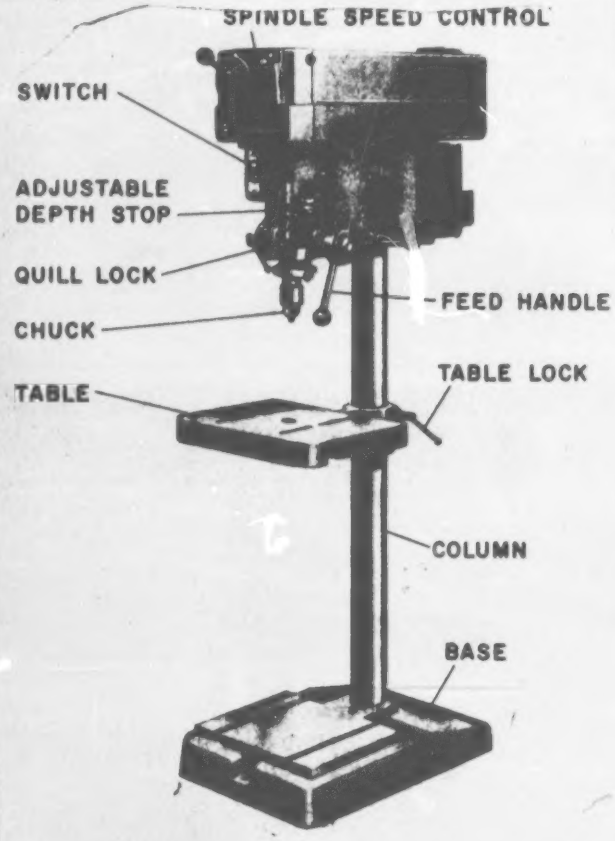
The learner will, in writing, list the safety rules pertaining to drilling operations and he will orally identify the basic parts of a drill, a portable hand drill, and a drill press. He will do this with 80% proficiency.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
8.1	The learner will, in writing, list the basic safety rules to be followed while using a drill press. 1) Wear eye protection 2) Properly clamp the work piece 3) Dress properly 4) Keep the drills sharp 5) Use the correct speed 6) Never force the drill 7) Store the chuck key properly	8.1	Write the safety rules to follow while using a drill press.
8.2	In writing, the learner will list the basic safety rules to be followed while operating a portable electric drill. 1) Check the cord condition 2) Keep cord from hot or oily surfaces 3) Never use near inflammable vapors or gases 4) Make sure hands are dry 5) Store the chuck key properly 6) Wear eye protection	8.2	Write the six (6) safety rules to be followed while operating a portable hand drill.

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 8.0 cont'd. DRILLING OPERATIONS

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
8.3	The learner will, orally, identify the basic parts of a drill press.	8.3	Identify, orally, these parts of a drill press: 1. speed control 2. switch 3. depth stop 4. quill lock 5. chuck 6. chuck key 7. table 8. feed handle 9. table lock 10. column 11. base



COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 8.0 cont'd. DRILLING OPERATIONS

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
8.4	The learner will identify, orally, the three (3) most commonly used machine drill bits and their basic components. A. Drill Bits 1. straight shank 2. tapered shank 3. counter sink B. Basic Components of a Drill Bit 1. shank 2. body 3. flutes 4. cutting lip 5. body clearance 6. dead center 7. web thickness	8.4	Identify, orally, the three (3) drill bits shown you and name the seven (7) basic parts of each.
8.5	The learner will safely and accurately demonstrate his ability to drill a hole using the portable hand drill.	8.5	Demonstrate your ability to accurately drill a hole, using a portable hand drill, twist drill, punch, and hammer following these instructions. 1. Check safety practices 2. Place drill in chuck 3. Store chuck key 4. Locate the hole and punch center 5. Fasten the work securely 6. Turn on the power 7. Apply even pressure 8. Reduce pressure when drill point begins to cut through
8.6	The learner will safely and accurately demonstrate his ability to drill a hole using a drill press.	8.6	Demonstrate your ability to safely and accurately drill a hole using a drill press and the materials issued to you. Follow these instructions:

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 8.0 cont'd. DRILLING OPERATIONS

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		8.6	1. State the basic safety rules 2. Locate the hole and center punch 3. Fasten the work securely 4. Adjust the speed 5. Turn on power 6. Apply even pressure 7. Lubricate, if necessary 8. Reduce pressure when drill point begins to cut through the material. 9. Remove drill 10. Store chuck key 11. Clean the drill press
8.7	The learner will demonstrate the safe and proper method to countersink a hole with a countersink and a drill press.	8.7	Using the materials and equipment issued by your instructor, demonstrate the proper method of countersinking a drilled hole. Follow these instructions: 1. State the basic safety rules 2. Locate and drill the pilot hole in the materials issued. Use the proper operating procedures for drilling. 3. Adjust the speed 4. Apply light pressure 5. Lubricate, if necessary 6. Countersink the holes.

METHOD / MEDIA ANALYSIS

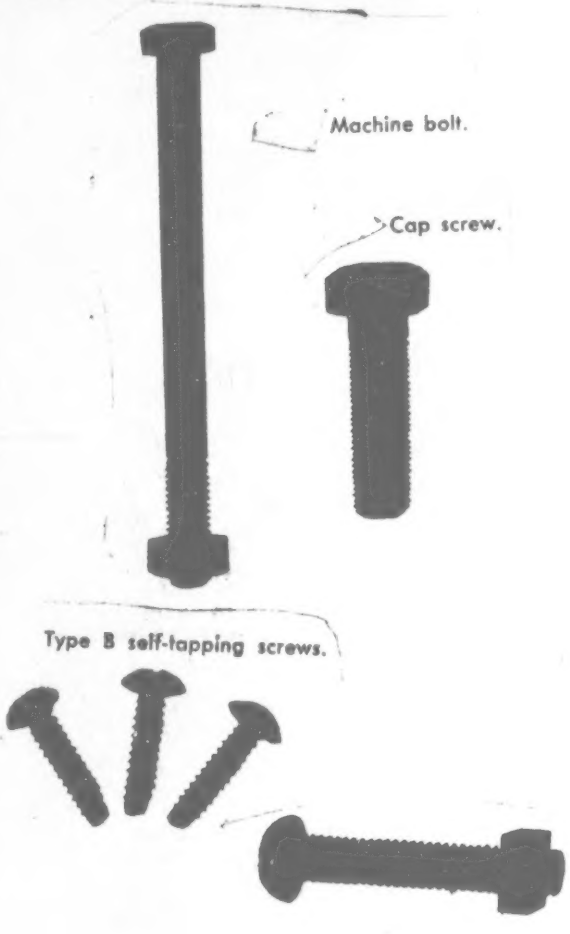
Terminal Performance Objective - 8.0

I. P. No.	M/M No.	Method / Media Selection
8.1	8.1.1	Lecture Demonstration Film Handout Sheet
8.2	8.2.1	Lecture Demonstration Film Handout Sheet
8.3	8.3.1	Demonstration
8.4	8.4.1	Demonstration Tools
8.5	8.5.1	Demonstration Tools and Equipment Observation
8.6	8.6.1	Demonstration Tools and Equipment Observation
8.7	8.7.1	Demonstration Tools and Equipment Observation

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 9.0 FASTENINGS

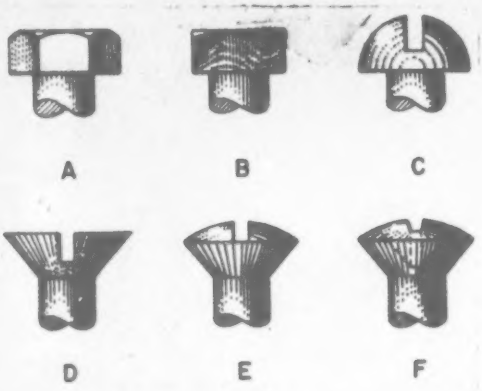
With 80% proficiency, the learner will, in writing or orally, demonstrate his ability to properly fasten metal pieces, using bolts, screws, rivets or soldering.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
9.1	In writing, the learner will identify four (4) commonly used metal screws and bolts. 	9.1	Identify in writing, four (4) commonly used metal bolts and screws from the illustration sheet given you.

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 9.0 cont'd.

FASTENINGS

.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
9.2	The learner will identify, in writing, the four (4) common head styles for threaded fasteners.  Common head styles for threaded fasteners. A. Hexagon. B. Square. C. Round. D. Flat. E. Oval. F. Phillips.	9.2	On the handout sheet, identify six (6) fastener head styles, sketched by your instructor.
9.3	The learner will, in writing, define "riveting" - "the process of inserting a metal pin into a hole and clinching it so that there is a head at each end."	9.3	Define, in writing, the term "riveting".
9.4	Define, orally, three (3) rivet head types: Rivet head types: A. Flat. B. Round. C. Countersunk.	9.4	Identify, orally, the three (3) rivet head types shown.

COURSE MACHINE SHOP 1A
9th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 9.0 cont'd. FASTENINGS

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
9.5	The learner will properly and accurately hand set rivets, using the following tools and equipment: a) Ball peen hammer b) Rivet set c) Hand punch d) Portable electric drill e) Sheet metal	9.5	Hand set a rivet in the stock pieces issued by your instructor, Use the tools and materials issued , following these steps of procedure: 1. Layout and locate holes with the rivets located at least two shank diameters from the edge of the joint and at least three (3) shank diameters from other rivets. 2. Select a drill of the same diameter as the rivet shank and safely drill the holes. 3. Insert the rivet in the hole. Shank extension should be 1 1/2 diameters beyond the metal. 4. Vise clamp the rivet set and peen the rivet shank to form a second head on the rivet.
9.6	The learner will demonstrate his ability to accurately join metals by soldering following four (4) basic rules. 1. All surfaces to be soldered must be clean 2. Use a flux to prevent oxidation and aid the solder flow. 3. Enough heat must be applied to melt the solder. 4. The solder must be the correct type for the work.	9.6	Using the materials and tools issued, solder the stock together following the four (4) basic soldering rules given.

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 9.0

I. P. No.	M/M No.	Method / Media Selection
9.1	9.1.1	Demonstration
		Samples
		Handout Sheet
9.2	9.2.1	Demonstration
		Samples
		Handout Sheet
9.3	9.3.1	Lecture
		Samples
		Handout Sheet
9.4	9.4.1	Lecture
		Samples
9.5	9.5.1	Demonstration
		Materials
		Tools and Equipment
		Observation
9.6	9.6.1	Demonstration
		Materials
		Tools and Equipment
		Materials

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 10.0 ABRASIVES

The learner will, orally, define the terms "abrasive" and "grain" size. The learner will also, by written examination, recall the two (2) major types of abrasive at a proficiency level of 75%.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
10.1	Define, orally, the term "abrasive". Abrasive : any hard, sharp material used to wear away another.	10.1	Orally define the term "abrasive" to the instructor.
10.2	The learner will, by written examination, recall the two (2) major types of abrasives. 1. Natural - mineral sources 2. Artificial - man-made	10.2	Complete the following statements: 1._____ abrasives are those made by nature. 2._____ abrasives are those made by man.
10.3	The learner will, orally, define the term "grain" to the instructor. Grain: sifted through screens to determine the size. Example: No. 80 grit will sift through a screen with 80 openings per inch.	10.3	Define, orally, the term "grain" to the instructor.

METHOD / MEDIA ANALYSIS

Terminal Performance Objective - 10.0

I. P. No.	M/M No.	Method / Media Selection
10.1	10.1.1	Lecture
		Handout Sheet
10.2	10.2.1	Lecture
		Samples
		Handout Sheet
10.3	10.3.1	Lecture

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 11.0 FINISHING

The learner, with 80% proficiency, will demonstrate his ability to define a decorative or protective finish for metals and state how metals are prepared for finishing.

O.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
11.1	The learner will define, in writing, the basic methods of metal finishes. 1. Wax finish - waxing and polishing . 2. Clear lacquer - thin, even coat of clear lacquer. 3. Black antique - black lacquer coat allowed to dry then rubbed with abrasive cloth. 4. Enamels and lacquers - a primer as a base, then colored enamel or lacquers applied.	11.1	Define, in writing, the following metal finishes: 1. Wax finish 2. Clear lacquer 3. Black antique 4. Enamels and colored lacquers
11.2	The learner will demonstrate, orally, his ability to prepare a metal surface for finishing. 1. Remove burrs and file marks . 2. Remove oxidation and dirt. 3. Remove oil and grease with solvents.	11.2	Explain, orally, how you would prepare a metal surface for finishing.

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METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 11.0

I. F. No.	M/M No.	Method / Media Selection
11.1	11.1.1	Lecture
		Handout Sheet
		Samples
11.2	11.2.1	Lecture
		Demonstration

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 12.0

SHEET METALS

The learner will, in writing, list the safety rules of the sheet metals laboratory and will, with 75% proficiency, demonstrate by performance, his ability to cut, form, shape, and assemble sheet metal stock using hand and bench tools.

O. .	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
12.1	The learner will write the following safety rules to be practiced in the sheet metals laboratory: 1) Handle sheet metal with care 2) Use gloves, if possible 3) Report cuts immediately, no matter how minor 4) Never brush metal with your hand - use a brush 5) Keep tools clean and sharp 6) Keep your hands clear of the squaring shear blade and your feet from beneath the treadle 7) Get help when cutting larger pieces 8) Place scrap pieces in scrap box 9) Wear eye protection 10) Ask permission before operating any machinery	12.1	List, in writing, the safety rules of the sheet metals laboratory.
12.2	The learner will identify, orally, these four (4) commonly used metals of the sheet metals laboratory. 1) Galvanized sheet 2) Tin plate 3) Aluminum sheet 4) Perforated metal sheet	12.2	Identify, orally, the four (4) different metal samples shown.
12.3	The learner will identify, orally, the following sheet metal hand tools: 1) Tin snips 2) Mallet 3) Hand Seamer 4) Hand groover 5) Tinner's setting down hammer 6) Hand metal punch	12.3	Identify, orally, the six (6) basic hand tools displayed.

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 12.0 cont'd. SHEET METALS

.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
2.4	Identify, orally, the following bench equipment: 1) Stakes 2) Bar folder 3) Box and pan brake 4) Slip roll former	12.4	Identify, orally, four (4) pieces of bench mounted forming equipment after an introduction to each by your instructor.
12.5	Given a drawing of a sheet metal box, the learner will lay out and transfer the pattern to sheet metal. He will cut, form, and fasten the project.	12.5	Lay out a sheet metal open-top box showing the proper over-all dimensions and shape. Cut and form the metal into a completed product. Follow these steps of procedure. 1) Draw a square or rectangle equal to the size of the box bottom. 2) Draw the sides and ends so that they are of equal height. 3) Add material for corner lap seams. 4) Add material for the hems.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 12.0

I. P. No.	M/M No.	Method / Media Selection
12.1	12.1.1	Lecture Demonstration Film Handout Sheet
12.2	12.2.1	Lecture Samples
12.3	12.3.1	Demonstration Film Tool Samples
12.4	12.4.1	Demonstration Film
12.5	12.5.1	Demonstration Materials Tools and Equipment Handout Sheet

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 13.0 BENCH METALS

The learner will, orally, define the two (2) classifications of metals. He will distinguish the differences between various properties of metal by written examination. A proficiency level of 75% is expected of the learner.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
13.1	The learner will orally define the following two (2) classifications of metals: 1) Ferrous metal: contains iron 2) Non-Ferrous metal - contains no iron	13.1	Orally define the two (2) major classifications of metals to the instructor.
13.2	The learner will, by written examination, distinguish the differences between various properties of metal.	13.2	In the spaces provided place the letter which represents the most accurate description (right column) of that property of metal (left column). Fusibility — A. Allows metal to resist penetration Elasticity — B. Allows metal to be drawn-out without breaking Hardness — C. Allows metal to return to its original shape after bending Ductility — D. Allows metal to become liquid easily and join with other metals.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 13.0

I. P. No.	M/M No.	Method / Media Selection
13.1	13.1.1	Lecture
13.2	13.2.1	Lecture
		Film
		Samples
		Handout Sheet

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 14.0 WELDING

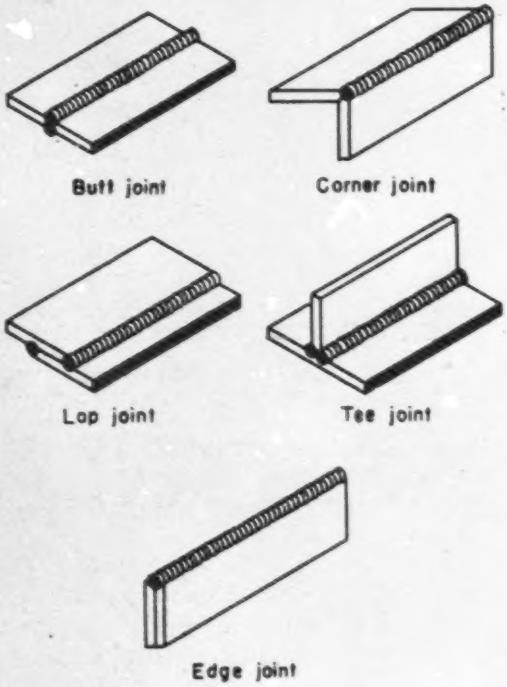
The learner will define "welding" in writing, and will, with 75% proficiency, demonstrate his his ability to safely join metals, using arc and oxy-acetylene welding equipment.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
14.1	The learner will define in writing, the process of welding metals. Welding - the process of joining metal parts by applying heat to melt the edges or surfaces until two parts join. Extra metal is sometimes added to the weld by melting a metal rod into the molten puddle.	14.1	Define in writing, the term "welding".
14.2	The learner will identify, in writing, the safety rules of welding. 1. Wear protective clothing and gloves 2. Wear eye protection 3. Never weld near oil or grease or on containers that have contained inflammables. 4. Keep the floor area clean 5. Keep "spectators" away from work area 6. Hold your hand slightly above a piece of metal before touching it to see if it is hot.	14.2	Write the safety rules of welding.

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 14.0 cont'd.

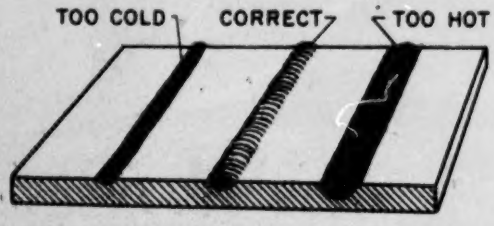
WELDING

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
14.3	The learner will identify five (5) major types of welds. The five major types of welds used to join metal.  Butt joint Corner joint Lap joint Tee joint Edge joint	14.3	Identify, orally, the five (5) basic weld examples, shown you by your instructor.

COURSE MACHINE SHOP IA
9th Grade

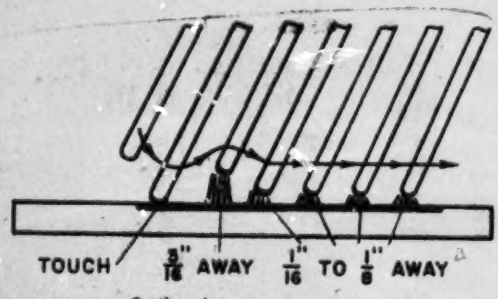
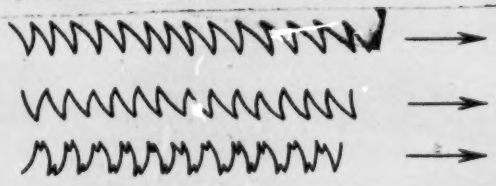
TERMINAL PERFORMANCE OBJECTIVE NO. 14.0 cont'd.

WELDING

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
14.4	The learner will identify, orally, a welding bead that is: (a) too cold (b) correct (c) too hot Beads made with an arc that is too cold, with a correct or normal arc, and with an arc that is too hot.  	14.4	Given three (3) samples showing different welded beads, orally identify the conditions under which these beads were formed. (1) too much amperage (2) correct amperage (3) amperage too low
14.5	The learner will identify, orally, the major components of an electric arc welder. 1) positive cable 2) ground clamp and cable 3) electrode holder 4) amperage selector	14.5	After class instruction, identify orally the major components of an arc welding unit.

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 14.0 cont'd. WELDING

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
14.6	The learner will demonstrate his ability to strike an arc and weld two (2) metal pieces together.	14.6	After the arc unit has been pre-adjusted by the instructor, you will strike an arc and lay a bead following these instructions:
	 Strike the arc as you would scratch a match.		1) Clean the stock piece issued you 2) Confirm with the instructor that the unit has been pre-adjusted prior to turning the switch to "on". 3) Lower the face shield 4) Strike an arc
			 These are some of the weaving motions that can be done in arc welding.
		14.6	5) After arc has been established, move it slowly along the material at a uniform rate

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 14.0 cont'd. WELDING

O.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		14.6	6) Study the bead after completion to make certain it was done correctly. (a) too fast - a thin bead (b) too slow - a bead too large and too deep with wasted material 7) Turn off the unit.
14.7	The learner will define, in writing, the basic principles involved in oxy-acetylene welding. (a) Oxygen and acetylene mixed in correct proportions burns with an extremely hot flame which readily melts metal.	14.7	In writing, define the basic principles of gas welding.
14.8	The learner will identify, orally, the basic components of a gas welding unit. 1) Cylinder for oxygen 2) Cylinder for acetylene 3) Two regulators 4) Red hose (acetylene) 5) Green hose (oxygen) 6) Safety lighter (striker) 7) Torch 8) Valve wrench	14.8	Shown a gas welding unit, you will orally identify and define the major components.
14.9	The learner, given proper instruction, will lay a welding bead with an oxy-acetylene unit.	14.9	Lay a sample bead on the stock issued, following this procedure: 1) Clean and clamp stock together 2) Place eye protection over your forehead 3) Loosen pressure regulator valves

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 14.0 WELDING

O. .	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		14.9	4) Open oxygen cylinder valve wide open (gradually) 5) Open acetylene cylinder valve 1/2 to 1 turn. NEVER MORE. 6) Adjust both cylinder valves to about five (5) PSI. 7) Open the acetylene valve on the torch a full 1/4 turn and light with striker. Adjust the flame until it begins to jump away from the torch tip, then reduce acetylene slightly until the flame is just blowing away from the tip. 8) Open the torch oxygen vavle until you get a neutral flame.

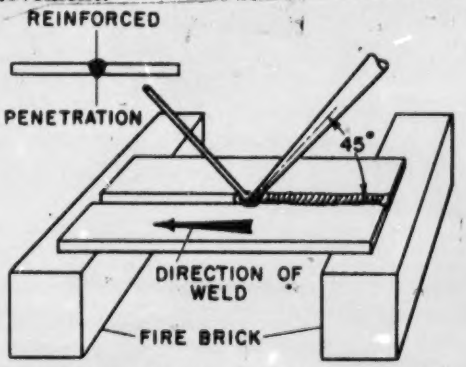
a

b

9) Lower eye protection
10) Hold the tip of the flame 1/16 from the metal.
11) Using the rod issued by the instructor, form a puddle on one end and begin

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 14.0 cont'd. WELDING

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		14.9	melting the rod into the puddle and build the weld up about 25%. 12) Weave the torch back and forth slightly, moving the rod with just the opposit movement.  13) Shut off the unit in reversed sequence from lighting. (Acetylene first). 14) Check the bead for penetration and pattern (appearance).

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 14.0

I. P. No.	M/M No.	Method / Media Selection
14.1	14.1.1	Lecture
		Text
		Handout Sheet
14.2	14.21	Lecture
		Demonstration
		Text
		Handout Sheet
14.3	14.31	Lecture
		Samples
14.4	14.41	Demonstration
		Samples
14.5	14.5.1	Demonstration
		Equipment
		Text
14.6	14.61	Demonstration
		Tools and Equipment
		Text
		Handout Sheet
14.7	14.71	Lecture
		Text
		Handout Sheet

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 14.0 cont'd.

I. P. No.	M/M No.	Method / Media Selection
14.8	14.8.1	Demonstration
		Tools
		Equipment
		Text
14.9	14.9 .1	Demonstration ..
		Tools
		Equipment
		Materials
		Handout Sheet

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 15.0

I. P. No.	M/M No.	Method / Media Selection
15.1	15.1.1	Lecture
		Demonstration
		Tools
		Handout Sheet
15.2	15.2.1	Demonstration
		Text
		Tools
		Equipment
		Materials

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 15.0 HAND FORGING

The learner will, by written examination, demonstrate his knowledge of various tools used in the area of hand forging. Also, the learner will use two forging processes to construct a practical exercise. A proficiency level of 75% is expected of the learner.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
15.1	The learner will demonstrate, by written examination his knowledge of the various tools used in hand forging. 1. Anvil 2. Tongs 3. Sledge hammer 4. Cross peen hammer 5. Ball peen hammer 6. Straight peen hammer 7. Hot chisel hammer	15.1	Complete the following statements by supplying the missing word or words. 1. The ___ of the anvil is used for shaping circular metal parts. 2. Hot metal is held with the aid of _____ 3. Common hammers used to forge metals are the _____ -peen, _____ -peen, _____ -peen, and the _____
15.2	The learner will, by practical application, demonstrate his ability to do one of the following processes in connection with hand forging: a. Tapering b. Drawing-out c. Bending d. Upsetting e. Twisting	15.2	Select a project to be hand forged that will incorporate one of the following operations. a. Tapering b. Drawing-out c. Bending d. Upsetting e. Twisting

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 16.0

LATHE

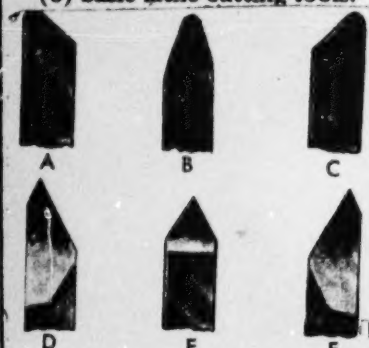
The learner will identify, orally, the basic parts of an engine lathe and lathe cutting tools. He will demonstrate his ability to safely use and properly clean a lathe. He will do this with 75% proficiency.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
16.1	The learner will, in writing, list the basic safety rules of the lathe operation. 1) Ask permission before using 2) Dress properly 3) Wear eye protection 4) Never adjust the lathe while it is running 5) Remove chips only with a brush 6) Stop the lathe to check measurements	16.1	In writing, list and define the basic safety rules of lathe operation.
16.2	The learner will identify, orally, the sixteen (16) basic parts of a lathe. 1) bed 2) ways 3) headstock 4) live center 5) face plate 6) back gear lever 7) feed reverse lever 8) gear box 9) apron 10) chuck knob 11) feed selector lever 12) half nut lever 13) lead screw 14) tail stock 15) compound rest 16) pulley cover	16.2	Shown a metal lathe by your instructor, orally identify it's sixteen (16) basic parts and define their purpose.

COURSE MACHINE SHOP IA
9th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 16.0 cont'd. LATHE

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
16.3	The learner will identify and define orally, the six (6) basic lathe cutting tools.	16.3	Identify, orally, the six (6) basic lathe cutting tools displayed.
16.4	The learner will demonstrate his ability to properly complete a lathe turning operation using a selected or assigned project.	16.4	Safely and accurately demonstrate the use of an engine lathe to complete an instructor assigned or student selected laboratory project.



Lathe cutting tools. A. Left-cut turning. B. Round-nose. C. Right-cut turning. D. Left-cut side facing. E. Threading. F. Right-cut side facing.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 16.0

I. P. No.	M/M No.	Method / Media Selection
16.1	16.1.1	Lecture
		Demonstration
		Text
		Handout Sheet
16.2	16.2.1	Lecture
		Demonstration
		Equipment
		Handout
16.3	16.3.1	Demonstration
		Tools
16.4	16.4.1	Lecture
		Demonstration
		Tools
		Equipment

MACHINE SHOP IB

ACCREDITATION NO. 5847B

LENGTH OF COURSE: 1 SEMESTER

GRADE LEVEL: 9th

PROGRAM PATH: CAREER EDUCATION, PRE-TECHNICAL, COLLEGE

PREREQUISITE(S): 7th & 8th METALS & METALS IA

COURSE DESCRIPTION:

This course of study is designed as a 9th grade level course of (1) one semester's length. It is to be followed to review, reinforce and expand the basic knowledge previously learned.

MACHINE SHOP IB

1.0 Orientation

2.0 Safety

3.0 Introduction to Metals

4.0 Occupations

5.0 Lay-out and Measuring

6.0 Planning

7.0 Hand Tools

8.0 Abrasives

9.0 Drilling

10.0 Sheet Metals

11.0 Bench Metals

12.0 Welding

13.0 Forging

14.0 Lathe

15.0 Finishing

NOTE:

This course of study has been designed to incorporate both Machine Shop IA (Accreditation No. 5847A) and Machine Shop IB (Accreditation No. 5847B). Each are ninth (9th) grade level courses and designed for one (1) semester in length. Metals 7 (No. 5861) and Metals 8 (No. 5862) constitute the foundation for these courses of study and to introduce, review, or reinforce basic skills were repeated in part. Additions were made to increase the scope and content.

COURSE MACHINE SHOP IB
9th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 1.0 ORIENTATION

The learner will define, in writing, and with a proficiency of 80%, the rules and regulations governing conduct in the Metals Laboratory. He will define, in writing, the grading system used.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
1.1	The learner will write the basic rules and regulations, listed below, governing conduct and responsibilities in the Metals Laboratory. 1. No horseplay 2. Care of tools and Equipment 3. Use the right tool for the job 4. Be a good housekeeper 5. Observe all safety rules	1.1	Write the five (5) rules and regulations governing conduct and responsibilities for the Metals Laboratory.
1.2	The learner will, in writing, demonstrate his understanding of the grading system used and will determine his letter grade using the approved criteria measurements.	1.2	Using instructor approved criteria measurements, compute in writing, your grade for a grading period.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 1.0

I. P. No.	M/M No.	Method / Media Selection
1.1	1.1.1	Lecture
		Handout Sheet
1.2	1.2.1	Lecture
		Demonstration
		Handout Sheet

COURSE MACHINE SHOP IB
9th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 2.0 SAFETY

The learner will demonstrate, by performance and in writing, his ability to understand and abide by the rules of safety as they apply to the Metals Laboratory.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
2.1	Given a written examination, the learner will list and define, in writing, the rules of safety for the Metals Laboratory. 1. No horseplay 2. Dress safely 3. Wear eye protection where required 4. Take proper care of tools 5. Use tools properly 6. Keep tools sharp and in good condition 7. Get permission before operating any machinery 8. Never adjust or oil a moving machine 9. Keep guards in place 10. Be a good housekeeper 11. Report all injuries to the instructor immediately	2.1	List, in writing, the safety rules given you by your instructor and write a brief description of each demonstrating your understanding of these rules.
2.2	The learner will demonstrate, by daily activities, his understanding of and willingness to obey the laboratory safety rules.	2.2	You will be observed daily on your willingness to abide by and practice the rules of safety.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 2.0

I. P. No.	M/M No.	Method / Media Selection
2.1	2.1.1	Lecture
		Demonstration
		Handout Sheet
		Film - Slides
2.2	2.2.1	Lecture
		Film

COURSE MACHINE SHOP IB
9th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 3.0

INTRODUCTION TO METALS

The learner will, by performance and written examination, identify the properties and physical characteristics of various metals.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
3.1	The learner will define the following metal terms in writing: A. Ferrous - contains iron B. Non-Ferrous - contains no iron C. Alloy - mixture of two (2) or more metals	3.1	Define, in writing, the following terms: 1. Ferrous 2. Non-Ferrous 3. Alloy
3.2	Given seven (7) metal characteristics, the learner will define each in writing. 1. Hardness - resistance to penetration 2. Brittleness - susceptibility to fracture 3. Malleability - ability to be hammered or rolled to shape. 4. Ductility - ability to be drawn to shape 5. Elasticity - ability to be returned to original shape. 6. Fusibility - ease of liquification by heating 7. Machinability - machine ease	3.2	Given seven (7) characteristics of metals, define each in writing.
3.3	The learner will, orally, identify seven (7) given metal samples. 1. Cast iron 2. Mild steel 3. Tool steel 4. Aluminum 5. Copper 6. Brass 7. Lead	3.3	Orally identify the seven (7) metal samples as displayed by the instructor.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 3.0

I. P. No.	M/M No.	Method / Media Selection
3.1	3.1.1	Lecture
		Samples
		Handout Sheet
3.2	3.2.1	Lecture
		Film
		Samples
		Handout Sheet
3.3	3.3.1	Lecture
		Demonstration
		Samples
		Film

COURSE MACHINE SHOP IB
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 4.0 OCCUPATIONS

The learner will, with 75% proficiency, in writing, list the occupational opportunities available in Metalworking. He will also choose one of these areas and research the opportunities, the advantages, and disadvantages of this particular area.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
4.1	The learner will list eight (8) occupational opportunities in the fields of Metalworking. The list may include the following: 1. Machinists 2. Tool and Die Makers 3. Sheet Metal Layout 4. Patternmaking (Foundry) 5. Arc Welders 6. Machine Tool Operators 7. Machinery Maintenance Men 8. Molders and Coremakers (Foundry) 9. Draftsmen 10. Electronic Technicians 11. Hydraulics Repairmen 12. Metalurgists 13. Computer Programmer 14. Mechanical Engineering 15. Salesmen	4.1	List in writing eight (8) occupational opportunities in the field of metalworking. Give a brief description of the responsibilities of each.
4.2	The learner will research and write a two-hundred (200) word composition on one (1) of the occupational opportunities in Metalworking.	4.2	Choose an occupational opportunity from a list of Metalworkers and write a two-hundred (200) word composition pertaining to that area, including the advantages and disadvantages.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 4.0

I. P. No.	M/M No.	Method / Media Selection
4.1		Lecture
		Text
		Media Center materials
		Examination sheet
4.2	4.2.1	Text
		Media Center materials
		Handout sheet

COURSE MACHINE SHOP IB
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 5.0 LAYOUT AND MEASURING

The learner will identify, orally, seven (7) basic measuring and six (6) basic layout tools and will demonstrate, by performance or in writing, the proper use of each.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
5.1	The learner will orally identify the following seven (7) basic measuring tools: 1. Steel rule 2. Steel square 3. Combination square 4. Sheet metal gauge 5. Inside calipers 6. Outside calipers 7. Hermaphrodite calipers	5.1	From a display showing the seven (7) basic hand tools for measuring, orally identify each.
5.2	The learner will orally identify the six (6) basic layout hand tools. 1. Hammer (ball peen) 2. Plastic mallet 3. Prick punch 4. Center punch 5. Dividers 6. Scribe	5.2	From a display of the six (6) basic layout tools, orally identify each.
5.3	The learner will demonstrate, in writing, his ability to measure straight lines divided into fractions of 1/16 inch.	5.3	On the examination sheet, using a bench rule and a pencil, draw the following lines: 1. 3 1/2 2. 4 1/16 3. 3 3/4 4. 5 5/16 5. 2 1/4 6. 3 1/8 7. 4 9/16 8. 5 11/16

COURSE MACHINE SHOP IB
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 5.0 cont'd. LAYOUT AND MEASURING

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
5.4	The learner will measure and record the diameters of two (2) cylindrical metal shapes using the following measuring tools: 1. Steel rule 2. Outside calipers 3. Inside calipers	5.4	Given two (2) metal shapes (one solid, and one hollow cylinder) write the outside diameter of both and the inside diameter of the hollow cylinder.
5.5	The learner will measure sheet metal thickness using a thickness gage.	5.5	Using a sheet metal gage, write the measurements of the sheet metal sample given you by your instructor.
5.6	The learner will demonstrate his ability to locate the center of a cylindrical metal piece, using a centering head from a combination set. LOCATING CENTER	5.6	With a centering head and a scribe, locate the center of the cylindrical sample issued by your instructor.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 5.0

I. P. No.	M/M No.	Method / Media Selection
5.1	5.1.1	Lecture
		Demonstration
		Film
		Tools
5.2	5.2.1	Lecture
		Demonstration
		Film
		Tools
5.3	5.3.1	Lecture
		Demonstration
		Handout Sheet
		Film
		Bench Rule
5.4	5.4.1	Demonstration
		Film
		Tools and Equipment
		Handout Sheet
5.5	5.5.1	Demonstration
		Tools and Equipment
		Metal Samples
		Handout Sheet

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 5.0 cont'd.

I. P. No.	M/M No.	Method / Media Selection
5.6	5.6.1	Demonstration Tools and Equipment Metal Samples

COURSE MACHINE SHOP IB
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 6.0 PLANNING

The learner will, with 80% proficiency, and in writing, demonstrate his understanding of a planning and procedure sheet by successfully completing both.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
6.1	The learner will, in writing, complete the planning sheet for an assigned or selected metal project to be completed in the laboratory.	6.1	Complete, in writing, the planning sheet issued by your instructor.
6.2	The learner will, in writing, complete a procedure sheet on the project selected in I. P. O. 6.1 (Machine Shop IA).	6.2	Complete a procedure sheet, listing completion steps from layout to finishing.

PLANNING SHEET

Date started_____
Date completed_____

Name_____ Grade _____
Project_____ H/R Section _____

BILL OF MATERIALS:

No. of pieces	size T	W	L	Name of part	Material	Unit cost	Total cost

EQUIPMENT AND TOOLS:

PROCEDURE OR STEPS:

1. Cut out stock.
2. Make part 1.
   a.
   b.
   c.
   d.
3. Make part 2.
   a.
   b.
   c.
   Etc
4. Make part 3.
5. Assemble.
6. Finish.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 6.0

I. P. No	M/M No	Method / Media Selection
6.1	6.1.1	Lecture
		Demonstration
		Handout Planning Sheet
6.2	6.2.1	Lecture
		Handout Sheet

COURSE MACHINE SHOP IB
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 7.0 HAND TOOLS

The learner will, with 70% proficiency, orally identify thirty (30) basic hand tools of the Machine Shop and will demonstrate (as observed by the instructor) his ability to clean and store these tools.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
7.1	The learner will, orally, identify the following thirty (30) hand tools: 1. hacksaw 2. cold chisel 3. twist drill 4. countersink 5. file - single cut 6. file - double cut 7. file - rasp 8. file - curved tooth 9. tap 10. tap wrench 11. pliers, combination, slip-joint 12. pliers, lineman's side-cutting 13. pliers, needle nose 14. pliers, diagonal cutting 15. open-end wrench 16. box-end wrench 17. combination wrench 18. adjustable open-end wrench 19. pipe wrench 20. monkey wrench 21. tin snips 22. aviation snips 23. hand seamer 24. tinner's riveting hammer 25. hand groover 26. rivet set 27. slotted screwdriver 28. phillips screwdriver 29. C - clamp 30. reamer	7.1	Orally identify each of the thirty (30) basic hand tools that are displayed by the instructor.

COURSE MACHINE SHOP IB
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 7.0 cont'd.

HAND TOOLS

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
7.2	The learner will demonstrate his ability to clean and properly store the basic hand tools.	7.2	You will be observed daily on your ability and willingness to clean and properly store the basic hand tools.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 7.0

I. P. No.	M/M No.	Method / Media Selection
7.1	7.1.1	Lecture
		Demonstration
		Film
		Tools
7.2	7.2.1	Demonstration
		Film
		Observation

COURSE MACHINE SHOP IB
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 8.0 ABRASIVES

The learner will, in writing and at a proficiency level of 75%, define "abrasives", and list two (2) natural, artificial, and polishing abrasives; also, the learner will orally demonstrate his knowledge of abrasive cloths and how to gra.. (size) is determined.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
8.1	The learner will, in writing, define the term "abrasive".	8.1	Write the definitions of "abrasive".
.2	The learner will, by written examination, list the two (2) types of natural and artificial abrasives.	8.2	1) Two (2) types of natural abrasives are: a. b. 2) Two (2) types of artificial abrasives are: a. b.
.3	The learner will, orally, demonstrate to the instructor his knowledge of abrasive cloths and how grain (size) is established.	8.3	Orally answer the following questions for the instructor: 1) What is abrasive cloth? 2) How is grain (size) determined? 3) What is the purpose of crocus cloth?
.4	The learner will, in writing, list two (2) types of polishing abrasives.	8.4	List two (2) types of abrasives that are used for polishing 1) 2)

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 8.0

I. P. No.	M/M No.	Method / Media Selection
8.1	8.1.1	Lecture
		Text
		Handout Sheet
8.2	8.2.1	Lecture
		Text
		Handout Sheet
8.3	8.3.1	Lecture
		Text
8.4	8.4.1	Demonstration
		Samples
		Handout Sheet

COURSE MACHINE SHOP IB
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 9.0 DRILLING OPERATIONS

With 80% proficiency, the learner will safely drill holes with a drill press demonstrating his ability to drill a blind hole, drill and hand ream a hole, and drill and thread a hole.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
9.1	Using the drill press, drill a 1/4 blind hole 3/8 deep in metal stock obeying all safety rules.	9.1	Using a drill press, drill a 1/4 blind hole, 3/8 deep in the metal stock issued by your instructor.
9.2	The learner will demonstrate his ability to drill and hand ream a hole using the drill press and a hand reamer. 1. Drill a hole 1/16 undersize. 2. Clamp the work piece in a vise. 3. Use a bar-type wrench to hold reamer. 4. Apply slight pressure and rotate the reamer. 5. Feed the reamer slowly into the work 6. Use cutting fluid if necessary. 7. Extract the reamer by lifting while continuing to rotate it in the same direction, NEVER turn a reamer counterclockwise.	9.2	Using a drill press and a hand reamer, ream a hole to your instructor's specifications. Use the tools and materials issued by your instructor.
9.3	Using a drill press, a tap-drill chart and necessary threading tools, the learner will demonstrate his ability to drill and cut an internal thread. 1. Select the proper drill and tap 2. Locate and drill the hole 3. Fasten the tap in tap wrench 4. Clamp the work piece 5. Insert tap in hole, apply even pressure, and start the tap 6. Check tap angle, release pressure and feed into hole 7. Apply cutting oil, back the tap off 1/4 turn after each complete turn to allow chips to fall free.	9.3	Using the specifications, tools and materials issued by your instructor, cut an internal thread in a drilled hole.

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METHOD / MEDIA ANALYSIS

Terminal Performance Objectives - 9.0

I. P. No.	M/M No.	Method / Media Selection
9.1	9.1.1	Demonstration
		Tools
		Equipment
		Materials
9.2	9.2.1	Demonstration
		Tools
		Equipment
		Materials
9.3	9.3.1	Demonstration
		Tools
		Equipment
		Materials

COURSE MACHINE SHOP IB
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 10.0

SHEET METAL

The learner will demonstrate his ability to cut, shape and assemble sheet metal products in square, and cylindrical shapes. He will do this with 80% proficiency.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
10.1	The learner will demonstrate his ability to lay out, cut and form a finished sheet metal product of rectangular shape.	10.1	On a layout sheet draw an open-top tool box with handle, showing all dimensions, hems, and seams. Cut, shape, and fasten this into a finished box.
10.2	The learner will demonstrate his ability to layout, cut and form a finished sheet metal product of cylindrical shape.	10.2	On a layout sheet, draw an open-top, closed-bottom cylindrical pencil holder showing all dimensions and seams. Cut shape and fasten into a finished container.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives 10.0

I. P. No.	M/M No.	Method / Media Selection
10.1	10.1.1	Demonstration
		Tool
		Equipment
		Materials
10.2	10.2.1	Demonstration
		Tools
		Equipment
		Materials

COURSE MACHINE SHOP IB
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 11.0 BENCH METALS

The learner will orally, identify five shades of bar metal and will design and fabricate a bench metal project using hand and machine tools with 75% proficiency.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
11.1	The learner will orally, identify the following five shapes of bar metals as displayed by the instructor. 	11.1	Orally identify the following shapes of bar metals as displayed by the instructor: 1. Flats 2. Rounds 3. Squares (bar) 4. Hexagon 5. Octagon
11.2	Using a full scale of 1 inch equals 1 inch, the learner will layout a pattern for a scroll project.	11.2	Layout a full scale pattern of a scroll project.
11.3	The learner will perform the necessary steps to fabricate the previously designed (ref. 1 . 2) scroll project.	11.3	Fabricate a scroll project using available metal bending tools and/or equipment.

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METHOD / MEDIA ANALYSIS

Terminal Performance Objectives 11.0

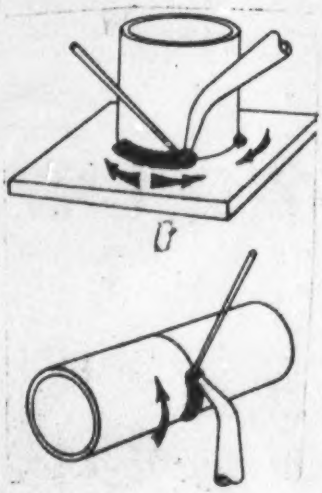
I. P. No.	M/M No.	Method / Media Selection
11.1	11.1.1	Lecture
		Demonstration
		Samples
11.2	11.2.1	Demonstration
		Tool
		Materials
		Text
		Design
11.3	11.3.1	Demonstration
		Tools
		Materials
		Design

COURSE MACHINE SHOP IB

9th Grade

TERMINAL PERFORMANCE OBJECTIVE NO. 12.0 WELDING

The learner will demonstrate his understanding of basic welding practices and will demonstrate his ability to do welding operations in advanced situations. These situations will include joining metals of different shapes, by welding and brazing. He will do this with 85% proficiency.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
12.1	The learner will demonstrate his ability to weld together two objects that are cylindrical and weld a cylinder to a flat surface. 	12.1	Safely and properly arc or gas weld together the following materials given you by your instructor a) Two cylindrical pieces b) Cylindrical to flat
12.2	The learner will orally, define "brazing" and "flux". Brazing - hard soldering, often using brass, bronze or silver alloy to join pieces without actually melting the base metal Flux - a chemical compound that cleans the surface to be brazed or welded; aids the flow of the filler material and prevents oxidation in the welding process.	12.2	Define, orally, the terms a) Brazing b) Flux

COURSE MACHINE SHOP IB
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 12.0 cont'd.

WELDING

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
12.3	The learner will demonstrate his ability to join two (2) metal pieces, using the brazing method.	12.3	Braze two (2) metal pieces issued by your instructor 1. Clean the (2) two parts 2. Clamp into position 3. Using previously learned skills, safely light the torch. 4. Pre-heat the pieces evenly where the braze is to start. Move the flame in a circular pattern over a small area of the total part to be brazed (do not hold flame in one place) . 5. Heat the filler rod slightly and stick into the powdered flux. 6. Hold the fluxed filler rod just ahead of the flame using most of flame to pre-heat the base metal. Apply heat until the flux and rod begin to flow. 7. Turn off the gas unit as previously learned. 8. Inspect the brazed joint

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives 12.0

I. P. No.	M/M No.	Method / Media Selection
12.1	12.1.1	Demonstration
		Tools and Equipment
		Materials
12.2	12.2.1	Lecture
		Tools
		Materials
		Text
12.3	12.3.1	Demonstration
		Tool and Equipment
		Materials
		Instruction Handout Sheet

COURSE MACHINE SHOP IB
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 13.0 FORGING

The learner will orally, or by written examination, prove his ability to correctly use the gas soldering furnace to perform a practical exercise in forge work. A proficiency level of 75% is expected of the learner.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
13.1	The learner will orally, demonstrate to the instructor his ability to operate the gas soldering furnace by recalling the following: 1. Turn on the gas jet until the gas ignites from pilot flame 2. Regulate the gas jet until a blue flame is obtained 3. Make certain that the gas jet is turned off after use	13.1	You will, before using the gas soldering furnace, orally demonstrate to your instructor the correct procedure to follow when using the furnace.
13.2	The learner will select and construct a practical exercise using one or both of the following forging processes: a. Tapering b. Drawing out	13.2	Construct a practical exercise using one or both of the following forging processes: a. Tapering b. Drawing out
13.3	The learner will heat treat the exercise (ref. 13.2) as directed by the instructor.	13.3	Given specific instructions by your instructor, you will heat treat the hand forged practical exercise made earlier (ref. 13.2)

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives 13.0

I. P. No.	M/M No.	Method / Media Selection
13.1	13.1.1	Demonstration
		Tool and Equipment
		Instruction Handout Sheet
13.2	13.2.1	Demonstration
		Design
		Tools and Equipment
		Materials
13.3	13.2.1	Demonstration
		Materials
		Tools and Equipment

COURSE MACHINE SHOP IB
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 14.0 LATHE

The learner will demonstrate his understanding of basic lathe operations and will demonstrate his ability to operate a lathe safely in advanced situations. These will include tool sharpening, counterboring and knurling. He will do this with 85% proficiency.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
14.1	The learner will write the basic safety rules of the lathe as learned in Machine Shop IA.	14.1	Write the safety rules learned in Machine Shop IA.
14.2	Given a cutting tool blank, the learner will grind a lathe cutting tool as directed by the instructor.	14.2	After proper instruction, you will sharpen a lathe tool as directed by your instructor.
14.3	The learner will demonstrate his ability to set up and operate a lathe to do a counterboring operation using the following equipment: 1. Lathe 2. Chuck 3. Counterboring tool	14.3	After an instructional demonstration, you will center the stock issued in the lathe chuck. Select the proper speed and counterbore to your instructor's specifications.
14.4	The learner will demonstrate his ability to set up and operate a lathe for knurling operations using the following equipment: 1. Lathe 2. Chuck 3. Knurling tool	14.4	After a demonstration, you will center the stock issued in the lathe chuck, select the correct speed using the back gears and knurl the stock to your instructor's specifications.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives 14.0

I. P. No.	M/M No.	Method / Media Selection
14.1	14.1.1	Lecture
		Handout Sheet
14.2	14.2.1	Demonstration
		Tools and Equipment
14.3	14.3.1	Demonstration
		Tools and Equipment
		Materials
14.4	14.4.1	Lecture
		Demonstration
		Tools and Equipment
		Materials

COURSE MACHINE SHOP I B
9th Grade

TERMINAL PERFORMANCE
OBJECTIVE NO. 15.0 FINISHING

The learner will, in writing or orally, define the surface preparation and application methods for the advanced methods of finishing these to include buffing, spraying or brushing enamel or paint, and painting a metal object, with 85% proficiency.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
15.1	The learner will, in writing, define (3) three reasons for applying a finish to metal articles: 1. Protection - protect against atmosphere and abrasion 2. Appearance - for a pleasing impression of quality 3. Identification - to stand out over competition or to blend into its surroundings.	15.1	List and define three (3) reasons for applying a finish to metal articles.
15.2	Given the necessary equipment and materials, the learner will demonstrate buffing a metal object to a high luster.	15.2	Select the correct wheel and compound from those given you by your instructor. Mount the wheel. Charge the buffing wheel with compound selected and polish the given object to a high lustre.
15.3	Given the proper material and a metal object, the learner will select a spraying or brushing paint or enamel and apply a finish without blemishes or uncoated surfaces.	15.3	Select a spraying or brushing paint or enamel and finish a project with an evenly coated and unblemished finish.

METHOD / MEDIA ANALYSIS

Terminal Performance Objectives 15.0

I. P. No.	M/M No.	Method / Media Selection
15.1	15.1.1	Lecture
		Text
		Handout Sheet
15.2	15.2.1	Demonstration
		Tool and Equipment
		Materials
15.3	15.3.1	Demonstration
		Materials